

WHAT IS CLAIMED IS:

1. A power steering system, comprising:

a torque sensor;

5 first and second passages, each including a pump-side portion and a cylinder-side portion;

a hydraulic cylinder with first and second chambers, the first and second chambers being connected to the first and second passages, respectively;

a hydraulic pump which supplies and discharges a hydraulic pressure to and from the first and second chambers of the hydraulic cylinder in accordance with steering
10 torque of the torque sensor;

a drain passage connected to at least one of the first and second passages; and

a switching valve arranged at a connection of the drain passage and the at least one passage,

when the hydraulic pump operates to discharge the hydraulic pressure
15 to the at least one passage, the switching valve providing fluid communication between the pump-side and cylinder-side portions of the at least one passage and closing off the drain passage, and

when the hydraulic pump stops, the switching valve providing fluid communication between the cylinder-side portion of the at least one passage and the
20 drain passage.

2. The power steering system as claimed in claim 1, wherein the switching valve comprises a valve body formed with a plurality of passage holes communicating with the pump-side and cylinder-side portions of the at least one passage and the drain passage,

25 a spool valve element slidably arranged in the valve body and comprising a first valve portion for opening and closing the passage holes corresponding to the pump-side and cylinder-side portions and a second valve portion for opening and closing the passage hole corresponding to the drain passage, and a resilient member for biasing the spool valve element in the direction of closing off fluid communication between the pump-side

and cylinder-side portions by the first valve portion and providing fluid communication between the cylinder-side portion and the drain passage by the second valve portion.

3. The power steering system as claimed in claim 2, wherein the first valve portion
5 of the spool valve element is formed with an orifice for providing fluid communication between the pump-side and cylinder-side portions of the at least one passage.

4. The power steering system as claimed in claim 2, wherein the first valve portion
10 of the spool valve element is formed with a recessed portion and a non-recessed portion on the side of the pump-side portion of the at least one passage,
wherein when the hydraulic pump operates, the recessed portion provides fluid communication between the pump-side and cylinder-side portions of the at least one passage, and the non-recessed portion is held by the valve body of the switching valve.

15 5. The power steering system as claimed in claim 2, wherein the resilient member comprises a coil spring accommodated in a spring chamber formed in the switching valve at an end opposite to the pump-side portion of the at least one passage,
wherein the spool valve element of the switching valve is formed with a communication passage for providing fluid communication between the cylinder-side
20 portion of the at least one passage and the spring chamber.

6. The power steering system as claimed in claim 2, further comprising a housing which accommodates the switching valve, the housing being formed with a bottomed valve hole, the valve hole having an opening concealed with a cap.
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7. The power steering system as claimed in claim 6, wherein the spool valve element comprises a restricting shaft arranged at an end on the side of the pump-side portion of the at least one passage, wherein when the hydraulic pump stops to operate, the restricting shaft abuts on a bottom of the valve hole to restrict axial position of the

spool valve element.

8. The power steering system as claimed in claim 2, wherein the switching valve is constructed such that when the hydraulic pump operates, the second valve portion closes off fluid communication between the cylinder-side portion of the at least one passage and the drain passage, then the first valve portion provides communication between the pump-side and cylinder-side portions of the at least one passage.

9. The power steering system as claimed in claim 1, further comprising a bypass passage arranged between the pump-side and cylinder-side portions of the at least one passage, the bypass passage bypassing the switching valve, and a check valve provided to the bypass passage, the check valve allowing hydraulic fluid to flow from the cylinder-side portion to the pump-side portion only.

10. The power steering system as claimed in claim 9, further comprising a negative-pressure check valve provided to the bypass passage at a position closer to the cylinder-side portion than the check valve, wherein when the negative pressure occurs in the bypass passage, the negative-pressure check valve opens to supply hydraulic fluid to the pump-side portion.

11. The power steering system as claimed in claim 1, further comprising a back-pressure regulating valve arranged downstream of the drain passage, the back-pressure regulating valve maintaining the hydraulic pressure within a hydraulic circuit at a predetermined value.

12. The power steering system as claimed in claim 1, wherein the switching valve is provided to each of the first and second passages.

13. The power steering system as claimed in claim 12, further comprising a first

return passage which connects the drain passage connected to the switching valve of the first passage and the cylinder-side portion of the second passage, a second return passage which connects the drain passage connected to the switching valve of the second passage and the cylinder-side portion of the first passage, and first and second
5 check valves provided to the first and second return passages, respectively, each check valve allowing hydraulic fluid to flow from the drain passage to the cylinder-side portion of the corresponding passage.

14. A power steering system, comprising:

10 a torque sensor;

first and second passages, each including a pump-side portion and a cylinder-side portion;

a hydraulic cylinder with first and second chambers, the first and second chambers being connected to the first and second passages, respectively;

15 a hydraulic pump which supplies and discharges a hydraulic pressure to and from the first and second chambers of the hydraulic cylinder in accordance with steering torque of the torque sensor;

first and second drain passages connected to the first and second passages, respectively;

20 first and second switching valves arranged at connections of the first and second drain passages and the first and second passages, respectively,

when the hydraulic pump operates to discharge the hydraulic pressure to one of the first and second passages, the corresponding switching valve providing fluid communication between the pump-side and cylinder-side portions of the one passage
25 and closing off the corresponding drain passage, and

when the hydraulic pump stops, the corresponding switching valve providing fluid communication between the cylinder-side portion of the one passage and the corresponding drain passage;

first and second back-pressure regulating valves arranged downstream of the

first and second drain passages, respectively, each back-pressure regulating valve maintaining the hydraulic pressure within a hydraulic circuit at a predetermined value;

a first return passage which connects the first drain passage connected to the first switching valve and the cylinder-side portion of the second passage;

5 a second return passage which connects the second drain passage connected to the second switching valve and the cylinder-side portion of the first passage; and

first and second check valves provided to the first and second return passages, respectively, each check valve allowing hydraulic fluid to flow from the corresponding drain passage to the cylinder-side portion of the corresponding passage.

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15. A power steering system, comprising:

means for detecting and outputting steering torque;

first and second passages, each including a pump-side portion and a cylinder-side portion;

15 a hydraulic cylinder with first and second chambers, the first and second chambers being connected to the first and second passages, respectively;

a hydraulic pump which supplies and discharges a hydraulic pressure to and from the first and second chambers of the hydraulic cylinder in accordance with steering torque of the means for detecting and outputting steering torque;

20 a drain passage connected to at least one of the first and second passages; and
a switching valve arranged at a connection of the drain passage and the at least one passage,

when the hydraulic pump operates to discharge the hydraulic pressure to the at least one passage, the switching valve providing fluid communication between the
25 pump-side and cylinder-side portions of the at least one passage and closing off the drain passage, and

when the hydraulic pump stops, the switching valve providing fluid communication between the cylinder-side portion of the at least one passage and the drain passage.

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